Fabrication of Regolith-Derived Radiation Shield

Completed Technology Project (2015 - 2016)

Project Introduction

Mars and asteroids have little or no atmosphere, and do not possess a magnetosphere that can protect humans, mechanisms and electronics from damaging Galactic Cosmic Radiation (GCR) and solar particle events (SPE) as does the Earth. These types of space radiation present one of the highest risks to a human crew during interplanetary journeys and to onboard electronics. This project aims to evaluate the effectiveness of carbonaceous asteroid materials as a potential radiation shielding material.

Mars and asteroids have little or no atmosphere, or a magnetosphere, to protect humans, mechanisms and electronics from damaging Galactic Cosmic Radiation (GCR) and solar particle events (SPE) as does the Earth. High energy protons are found in GCR and SPE, but the energy level is much higher for GCR (several GeV) compared to SPE (~10 MeV). These types of space radiation present one of the highest risks to a human crew during interplanetary journeys and to onboard electronics. This project aims at evaluating the effectiveness of carbonaceous asteroid materials as a potential radiation shielding material since they can contain hydrated minerals, and to fabricate protection panels using technology developed during FY14 project "3D Additive Construction with Regolith for Surface Systems". Surface Systems applications on Asteroids, the Moon, Mars and Martian moons will require the stabilization of loose, fine, dusty regolith to create a structure to mitigate radiation effects to protect humans, mechanisms, and electronics. This project will demonstrate in-situ construction of radiation shields using regolith simulants so that materials will not have to be transported from Earth.

Recent work performed at KSC has shown promising results in 3D printing a 0.2 meter dome from planetary regolith simulants using an existing 3D-positioning platform. This current project will utilize the 3D regolith printer technology to fabricate radiation shield elements that will be tested to determine their radiation stopping capability.

Anticipated Benefits

The **logistics required** to set up a human outpost on another planetary surface are vast and prohibitively expensive. Space transportation costs are high, so the corresponding value of **In-Situ Resource Utilization (ISRU)** to make **structures** using local materials is also high.

By developing new technologies to transport, position, emplace, bind and form a net shape with regolith, radiation shields and other structures can be built on Asteroids, the Moon, Mars and other moons so that humans and machines will be better protected from radiation during their missions which means higher reliability and safety.

Radiation shields will be used on planetary bodies by persons and equipment during their missions. Shields can be developed with varying thickness of the

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Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Kennedy Space Center (KSC)

Responsible Program:

Center Independent Research & Development: KSC IRAD

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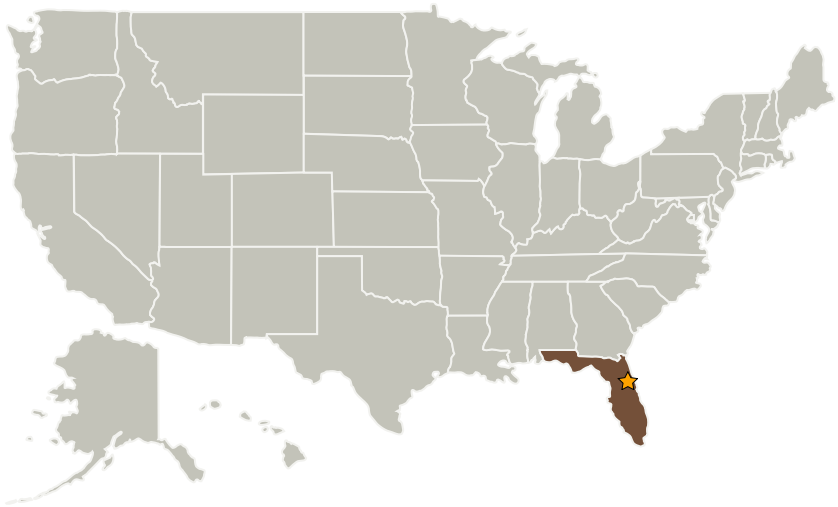
radiation barriers depending on the amount of protection required. Terrestrial applications in radiation protection with hydrated minerals are also possible.

This project helps to enable the human exploration of space by providing a means to mitigate the harmful effects of space radiation using locally acquired space resources at planetary locations.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Kennedy Space Center(KSC)	Lead Organization	NASA Center	Kennedy Space Center, Florida

Co-Funding Partners	Type	Location
University of Central Florida(UCF)	Academia	Orlando, Florida

Primary U.S. Work Locations
Florida

Project Management

Program Manager:
Barbara L Brown

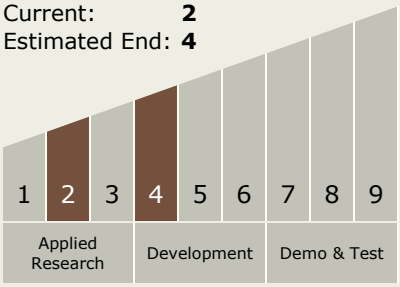
Project Manager:
Nancy P Zeitlin

Principal Investigator:
James G Mantovani

Co-Investigator:
Ivan I Townsend

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **4**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.5 Radiation
    - TX06.5.3 Protection Systems

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Links

Fabrication of Regolith Derived Radiation Shields
(no url provided)

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